

Superfocusing of light beams below the diffraction limit by photonic crystals with negative refraction

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Usual optical elements can not focus a light beam to a spot with a diameter smaller than half of the wavelength of the light. Recent work has shown that photonic crystals below the bandgap can exhibit negative refraction and amplify evanescent components. In contrast to previously studied imaging, in the case of focusing of a beam no seed evanescent waves are present in the input beam. Therefore we introduce directly before the slab of the photonic crystal an aperture or a saturable absorber which creates from the input beam weak evanescent components of sufficient amplitude. By numerical solution of the Maxwell equations we demonstrate the amplification of evanescent components with a constructive superposition and focusing to a spot below the diffraction limit for a realistic photonic crystal. In the Figure, superfocusing to a spot with FWHM of 0.25λ is shown for a 2D lattice of holes in GaAs with a lattice constant of 0.191λ , and an aperture width of 1.15λ .

